

PROGRESS REPORT  
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## A F-101 FLIGHT TEST

Nine flights were made during February, Table I shows that radar data was acquired on eight of these. One flight was aborted because of an antenna pressure failure. A summary of flights appears in Appendix A.

A mandatory Air Force technical order required changing the main landing gear on the F-101. Coincident with this work, the KA-45 aerial camera was installed, an antenna pressure leak repaired, and location determined for waveguide and components of the forward looking radar modification.

Flight 147 was primarily a functional test flight for the landing gear change, but provided a test of the KA-45 camera and radar.

TABLE I

## F-101 PROGRAM SUMMARY

February 1965

Flights Scheduled	9
Flights Accomplished	
Aircraft	
Functional Check Flights	1/2
Radar	
Productive Flights	5 1/2
Productive Flights prior to Failure	2
Non-Productive Flights	1
Flights Cancelled	None

Modifications and Ground Tests

Doppler Frequency Tracker

When video is lost as the DFT gate is located over a large water area, the antenna pod is driven rapidly to an extreme

position. A DFT memory system was devised, breadboarded and partially tested for the F-101 application.

This modification consists of adjusting a threshold circuit to sense a loss of video in the DFT gate which switches antenna position control from DFT to manual. The manual input is obtained from a potentiometer adjusted periodically by the radar operator in-flight to the position indicated by the antenna position meter. Thus the manual control will maintain the antenna in the last indicated position until the return of video causes the threshold circuit to return the system to DFT operation. Both the position control and the meter were already installed in the cockpit and require only to be calibrated.

#### Receiver

The Westinghouse parametric amplifier performed satisfactorily on the first two flights. Following normal operation on the low altitude run of flight 147, the radar operator observed receiver oscillations on his cockpit scope as the aircraft was climbing and accelerating. Post-flight test verified the oscillations. Because of the Operation Snowfex operations coming up the following day, the Tunnel Diode Amplifier was reinstalled in the system. Receiver operation was then normal, but with an increase of 1.7 db in noise figure. The par-amp is being checked in the laboratory.

Since the range boost tests were completed in January, the video amplifier was restored to its original configuration.

#### Recorder

A 400 cycle jitter was noticed on the film of each flight. The jitter is more bothersome with recorder 005 than 007. Although

the cause seems to be magnetic pick-up, the problem has not yet been corrected.

The film jam encountered on flight 153 was corrected by adjusting the position of a film loop sensor.

Tracking of recorder film speed with aircraft ground speed was tested on recorder 005 after flight 146. Over the range of 790 to 890 knots ground speed, the film speed varied 0.16 per cent from a nominal ground speed-film speed ratio. For flights from 45,000 feet altitude, film speed must track ground speed within 0.2 per cent during the dwell time of an antenna beamwidth, if azimuth resolution is to be degraded less than 5 feet.

Testing was started on type 2401 mylar base film to determine its operating and sensitometric characteristics. This film has a base 4.0 mils thick, compared to 5.5 mils of the 5401 acetate base. The mylar provides better dimensional stability and longer life.

#### Transmitter

A transmitter failure occurred during pre-flight for 147. After replacing two open resistors in a thyatron bias circuit and the TWT power supply transformer, normal operation was restored.

#### Antenna

Delamination of the antenna sealing fabric caused a pressure failure on flight 146. This was the fourth failure of antenna pressure seal in three years of flight test.

#### Flight Tests

Flights 148 through 153 were made in conjunction with Operation Snowfex, an army winter maneuver in Camp Drum, New York. This produced the most intense flight activity to date, with seven flights in

four days. Instead of completely pre-flighting the radar prior to each mission, the radar operator observations and system failure indicators were relied upon. Operation was excellent except for:

(1) lowered cathode ray tube intensity which produced maps of low signal-to-noise

(2) troubles associated with the cold on the last day.

Post flight checks after flight 153 indicated no change in transmitter power or system noise figure.

A pre-flight test has been added to check the recorder (CRT-film) transfer characteristic. However, since this is a film test, failure or degradation would not be determined until the flight film is developed.

Participation in Operation Snowfex required landing for re-fueling, and in one case, remaining overnight at the SAC base at Plattsburgh, N.Y. Since this base has no F-101 ground starting units, aircraft air pressure was used to start the engines and the bottles replenished prior to take-off.

The overnight stay at Plattsburgh exposed the aircraft and radar to a 12 hour cold soak of  $-12^{\circ}\text{F}$ . Approximately 30 minute warm-up time was required for the transmitter before it would not overload; 10 minutes is the usual warm-up time. The low temperature also caused trouble with the APN-102 doppler navigator, the instrumentation tape recorder transport, KA-45 film transport, recorder film transport, and aircraft flaps.

An electrical transient experienced when the accelerometer is connected to the velocity motion compensation integrator has caused the integrator to "ring" excessively. The following operating

procedure was successful 5 of the 6 times used:

- (1) ground the integrator input
- (2) 105 seconds after the start of roll table erection, connect the integrator to the VFO.
- (3) 15 seconds later, unground the integrator input and switch integrator gain to normal high gain.
- (4) 15 seconds later, end the erection of table and connect accelerometer to integrator input.

After examination of the instrumentation, it appeared the total elapsed time can be reduced from 135 to 35 seconds. The procedure will be refined on later flights.

#### B PHASE II FLIGHT TEST

Field Mod Kit #11, addition of focus power supply, has been shipped to the field for installation in system 003.

#### C SYSTEM

A study of the integrator network of the motion compensation system was started in an attempt to reduce the peak amplitude of both the transient and frequency response. Calculations and tests indicate that changing the damping ratio from .25 to .5 is desirable. This change and the new turn-on procedure should reduce the swing of the antenna pod in the F-101 to acceptable levels without degrading performance.

A report on the receiver phase linearity tests was released as STM 165.

D ANTENNA

Three of the six modules of antenna 003 have been bonded, reassembled, electrical tested and soldered, ready for electro-forming. Two other modules are bonded and are being assembled. The sixth is in the bonding process.

Results of the bonding are encouraging. Of 80 sticks bonded, only 12 were rejected because of minor leaks through the fabric and around the mounting lugs. Two sticks required rebonding, the others were repaired by recoating with resin.

In the soldering operation, some solder flows into the waveguide area. Control of the solder flow is more difficult since the sticks have been previously soldered. The excess solder is removed by etching, but requires repeated electrical and pressure tests to determine when the module is satisfactory.

Pressure tests on five spare modules showed at least two should be reworked. Antenna 002 is to be returned from the Phase II testing area and checked. Sufficient modules of either this antenna or spares will be reworked to assemble an antenna with the improved laminate bonding technique. Of the remaining modules for spares, only those showing excessive delamination will be reworked at this time.

E GROUND SUPPORT EQUIPMENT

The Unit Test Rack is complete except for three patch cables. Check-out has been completed satisfactorily with the power supply, receiver and synchronizer. Testing with the recorder remains to be performed.



Improvements on the Film Evaluator are continuing. The modification to the light source box is completed. Phototube circuitry changes have been checked out. Investigation is under-way on the following problems:

- (1) excessive background light with narrow source slit widths
- (2) too wide scanning slit width.

F SPARES

Thirty items of equipment spares were shipped last month. Only 24 items remain open, including those for Amendment 10. The list for Amendment 10 was closed this month and submitted to Accounting for pricing.

Three items of the Ground Support Equipment spares were shipped, leaving 12 open items.

APPENDIX A  
SUMMARY OF FLIGHTS

Flight No.	145	146	147
Date	2/2/65	2/4/65	2/19/65
Altitude	45000	45000	22500
Area	Norfolk, Va.	Pittsburgh, Pa.	Annapolis, Md.
Purposes	Flight test Westinghouse para-metric amplifier	Data acquisition	Functional test of aircraft, data acquisition, and test KA-45 operation.
Significant System Changes	Recorder 005 again installed in aircraft. Par-amp installed in receiver in place of Tunnel Diode Amplifier.		KA-45 aerial camera installed prior to flight.
Results	On near range, map is best from 1/3 to max. range. Resolution is good. Contrast is good in low level areas. 400 cps images occur on all large targets from clock 21 to the end. From clocks 14 to 20 on far range strip, contrast is very good. Some 75 mil imaging is seen near clock 14.	Pressure failure in antenna prevented transmitter operation.	Map best film 1/2 to 3/4 range but not as good as in some previous flights. At clocks 30 and 31 bridges at mid-range are smeared and have 400 cps images at clock 24, rotation varies from 10° to 80° CW over the range. Par-amp unstable after completion of radar run. KA-45 vacuum pump did not function properly.

SPECIAL HANDLING

Flight No.	148	149	150
Date	2/20/65	2/20/65	2/21/65
Altitude	45000	22500	22500
Area	Camp Drum, N.Y.	Camp Drum, N.Y.	Camp Drum, N.Y.
Purposes	Data acquisition during operation Snowfex.	Data acquisition during operation Snowfex	Data acquisition during operation Snowfex.
Significant System Changes	Tunnel diode amp. installed in place of par-amp. Velocity compensation not used because of short super-sonic run.	None	KA-45 vacuum pump changed from 28 VDC unit to 400 ~ unit.
Results	On far range, map is best from 1/3 to 2/3 range. Density and contrast is relatively low. On near range, map is best from mid-range to max range. At clock 13 there was a 5 sec rise in density at near range as antenna moved from 2.5° down to 1.5° down. Some loss in density may be due to extreme 2.5° position. Resolution below average.	Map good over most of the area. Resolution average and contact fair. Occasional smears near clocks 8, 10 and 14. Contrast lower in farthest 3/4 range. Some spurious vertical streaks at clocks 11 and 13. KA-45 film transport was erratic	Map fair from near to 2/3 range. Density (or signal intensity) drops starting at clock 2. No velocity compensation here. Rotation is approximately 30° CCW. Further fading over farthest half range starting at clock 9. Here antenna started downward and aircraft rolled 2 1/2° right. At clocks 13 & 14 rotation is about 30° CW. Uniformity better at clock 20. Far range faded out when antenna was up during last part of flight.

SPECIAL HANDLING

Flight No.	151	152	153
Date	2/21/65	2/22/65	2/22/65
Altitude	45000	45000	22500
Area	Camp Drum, N.Y.	Camp Drum, N.Y.	Camp Drum, N.Y.
Purposes	Data acquisition during operation Snowfex.	Data acquisition during operation Snowfex.	Data acquisition during operation Snowfex.
Significant System Changes	Velocity compensation not used.	System had cold soaked overnight at -12°F.	
Results	Map best from 1/4 to max range on near range strip. Difficult to determine resolution quality due to lack of distinct targets. Contrast fair. Water smeared at clock 10 on far range strip, the far side is faded out. 4° left drift may have caused this. Rest of this strip fair to 1/4 range.	On near range strip, map is best from 1/4 to max angle. Faded badly over near 1/4 range. Resolution average 20-25 ft. over best areas. Contrast fair in low level regions. Water somewhat cluttered. Many streaks on the film that detract from its appearance. On far range strip, the best is from 1/4 to 3/4 range. Map qualities about the same as the near range strip. Camp Drum barracks show well where parallel to flight path but fade where incidence not perpendicular.	Recorder jammed after one pass over target area. Over best part of this short map quality fair. Some sections over far range strip have good resolution and contrast. Bad smears and streaks on film attributed to jamming of recorder.

SPECIAL HANDLING

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